



Department of Computer Science
& Information Engineering

資 訊 工 程 系

人工智慧與邊緣運算實務

OD

Google Colab
進階應用

雲端計算 (Cloud Computing)

訓練 / 推論 / 儲存



雲端伺服器
Cloud Server

邊緣計算 (Edge Computing)

推論

非同步(可離線)

微量推論結果

深度學習模型

推論結果

AI 晶片

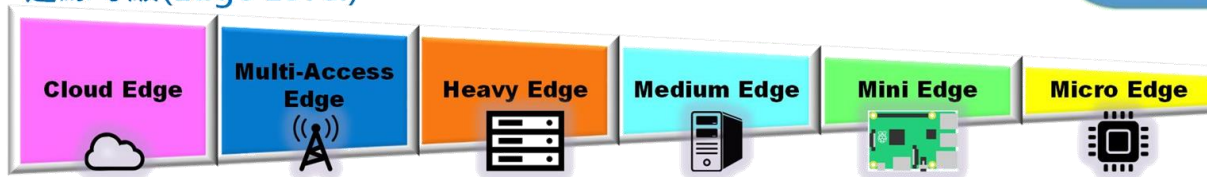
聲音 影像 感測器

低延遲

高隱私

低成本

邊緣等級(Edge Level)



資訊工程系 許哲豪 助理教授

簡報大綱

➤ Colab進階應用

- 程式碼片段
- 表單控制項
- 從攝影機取像
- 虛擬機檔案傳輸
- 雲端硬碟檔案傳輸
- 繪製OpenCV影像
- 資料可視化



Google Colab 新增程式碼片段

NTUST Edge AI - Ch-D Google Colab Advance Samples_01.ipynb ☆

檔案 編輯 檢視畫面 插入 執行階段 工具 說明 已儲存所有變更

+ 程式碼 + 文字

程式碼區

新增
程式碼片段

程式碼片段

程式碼片段 ×

篩選程式碼片段

- Adding form fields +
- Camera Capture +
- Cross-output communication +
- display.Javascript to execute JavaS... +
- Downloading files or importing data... +
- Downloading files to your local file s... +
- Evaluate a Javascript expression fr... +
- Hiding code +
- Importing a library that is not in Col... +
- Importing data from Google Sheets +
- Install [cartopy](http://scitools.org.u... +
- Install 7zip reader [libarchive](https:... +

Adding form fields

Forms example

Forms support multiple types of fields with type checking including sliders, date pickers input fields, dropdown menus, and dropdown menus that allow input.

#@title Example form fields
#@markdown Forms support many types of

```
no_type_checking = '' #@param
string_type = 'example' #@param {type:
slider_value = 142 #@param {type: "sl
number = 102 #@param {type: "number"}
date = '2010-11-05' #@param {type: "d
pick_me = "monday" #@param ["monday",
select_or_input = "apples" #@param ["a
#@markdown ---
```

查看來源筆記本

插入

程式碼片段範例 (1 of 3)

- **Adding form fields**
- **Camera Capture**
- Cross-output communication
- display.Javascript to execute JavaScript from Python
- Downloading files or importing data from Google Drive
- Downloading files to your local file system
- Evaluate a Javascript expression from Python with `eval_js`
- Hiding code
- Importing a library that is not in Colaboratory
- Importing data from Google Sheets
- Install [cartopy]
- Install 7zip reader [libarchive]
- Install GraphViz & [PyDot]
- Javascript to Python communication
- Jupyter Comms
- Jupyter Widgets

程式碼片段範例 (2 of 3)

- **Listing files in Google Drive Mounting Google Drive in your VM**
- Open files from GCS with gsutil
- Open files from GCS with the Cloud Storage Python API
- Open files from GitHub
- **Open files from Google Drive**
- Open files from your local file system
- Output Handling
- Pandas: display dataframes as interactive tables
- Pausing output processing
- **Saving data to Google Drive**
- Saving data to Google Sheets
- Saving data with gsutil
- Saving data with the Cloud Storage Python API
- Serving resources
- **Showing CV2 Images**
- Tagged Outputs
- Third-party Jupyter widgets

程式碼片段範例 (3 of 3)

- Using BigQuery with Cloud API
- Using BigQuery with Pandas API
- **Visualization:** Bar Plot in Altair
- Visualization: Histogram in Altair
- Visualization: Interactive Brushing in Altair
- Visualization: Interactive Scatter Plot in Altair
- Visualization: Linked Brushing in Altair
- Visualization: Linked Scatter-Plot and Histogram in Altair
- Visualization: Scatter Plot with Rolling Mean in Altair
- Visualization: Stacked Histogram in Altair
- Visualization: Time Series Line Plot in Altair

新增表單控制項 (1 of 2)

#@title Example form fields

#@markdown Forms support many types of fields.

no_type_checking = " #@param

string_type = 'example' #@param {type: "string"}

slider_value = 135 #@param {type: "slider", min: 100, max: 200}

number = 102 #@param {type: "number"}

date = '2010-11-05' #@param {type: "date"}

pick_me = "monday" #@param ['monday', 'tuesday', 'wednesday', 'thursday']

select_or_input = "apples" #@param ["apples", "bananas", "oranges"] {allow-input: true}

#@markdown ---

新增表單控制項(2 of 2)

Google Colab 新增表單

The image shows a Google Colab notebook with a form titled "Example form fields". The form contains several input fields and controls. Red boxes highlight specific elements, and red arrows point to their respective configuration panels:

- Form Fields:**
 - `no_type_checking: "` (text input)
 - `string_type: "example"` (text input)
 - `slider_value:` (slider control, value 135)
 - `number: 102` (text input)
 - `date: 2010 / 11 / 05` (date picker)
 - `pick_me: monday` (dropdown menu)
 - `select_or_input: apples` (select or input control)
- Configuration Panels:**
 - 編輯表單屬性 (Table Header):** Shows options for initial settings, auto-save, and display options. A red box highlights the "Table width" (表單寬度) field.
 - 編輯表單欄位 (Slider):** Shows configuration for the slider control, including minimum value (100), maximum value (200), and step (1). A red box highlights the "Slider value" (slider_value) field.
 - 編輯表單欄位 (Date):** Shows configuration for the date picker, including the date type (date). A red box highlights the "Date" (date) field.
 - 編輯表單欄位 (Dropdown):** Shows configuration for the dropdown menu, including the dropdown type (string) and the list of items (apples, bananas, oranges). A red box highlights the "Dropdown" (pick_me) field.
 - 編輯表單欄位 (Markdown):** Shows configuration for the markdown control, including the markdown type (markdown). A red box highlights the "Markdown" (select_or_input) field.
 - 輸入資料 (Raw):** Shows a list of data types (boolean, date, integer, number, raw, string). A red box highlights the "Raw" (no_type_checking) field.

從攝影機取像 (1 of 2)

定義 Java 取像函式

```
from IPython.display import display, Javascript
from google.colab.output import eval_js
from base64 import b64decode

def take_photo(filename='photo.jpg', quality=0.8):
    js = Javascript("""
    async function takePhoto(quality) {
      const div = document.createElement('div');
      const capture = document.createElement('button');
      capture.textContent = 'Capture';
      div.appendChild(capture);

      const video = document.createElement('video');
      video.style.display = 'block';
      const stream = await navigator.mediaDevices.getUserMedia({ video: true });

      document.body.appendChild(div);
      div.appendChild(video);
      video.srcObject = stream;
      await video.play();
```

```
      // Resize the output to fit the video element.
      google.colab.output.setIframeHeight(document.docum
entElement.scrollHeight, true);

      // Wait for Capture to be clicked.
      await new Promise((resolve) => capture.onclick = reso
lve);

      const canvas = document.createElement('canvas');
      canvas.width = video.videoWidth;
      canvas.height = video.videoHeight;
      canvas.getContext('2d').drawImage(video, 0, 0);
      stream.getVideoTracks()[0].stop();
      div.remove();
      return canvas.toDataURL('image/jpeg', quality);
    }
    """)
    display(js)
    data = eval_js('takePhoto({})'.format(quality))
    binary = b64decode(data.split(',')[1])
    with open(filename, 'wb') as f:
        f.write(binary)
    return filename
```

從攝影機取像 (2 of 2)

開始取像，當按下Capture時將影像存於虛擬機上

```
from IPython.display import Image
try:
    filename = take_photo()
    print('Saved to {}'.format(filename))
```

```
# Show the image which was just taken.
display(Image(filename))
except Exception as err:
    # Errors will be thrown if the user does not have a webcam
    # or if they do not
    # grant the page permission to access it.
    print(str(err))
```



Colab虛擬機與本地端下載/上傳

➤從Colab下載檔案到本地端

導入檔案處理函式庫

```
from google.colab import files
```

開啟文字檔，寫入內容。

```
with open('example.txt', 'w') as f:  
    f.write('some content' )
```

下載檔案到本地端

```
files.download('example.txt')
```

➤從本地端上傳檔案到Colab

導入檔案處理函式庫

```
from google.colab import files
```

選擇本地端檔案上傳到虛擬機

```
uploaded = files.upload()
```



掛載Google雲端硬碟到Colab VM

Google Drive 掛載

from google.colab import drive
drive.mount('/gdrive')

要允許這個筆記本存取你的 Google 雲端硬碟檔案嗎？

這個筆記本要求存取你的 Google 雲端硬碟檔案。獲得 Google 雲端硬碟存取權後，筆記本中執行的程式碼將可修改 Google 雲端硬碟的檔案。請務必在允許這項存取權前，謹慎審查筆記本中的程式碼。

不用了，謝謝 **1** 連線至 Google 雲端硬碟

使用 Google 帳戶登入

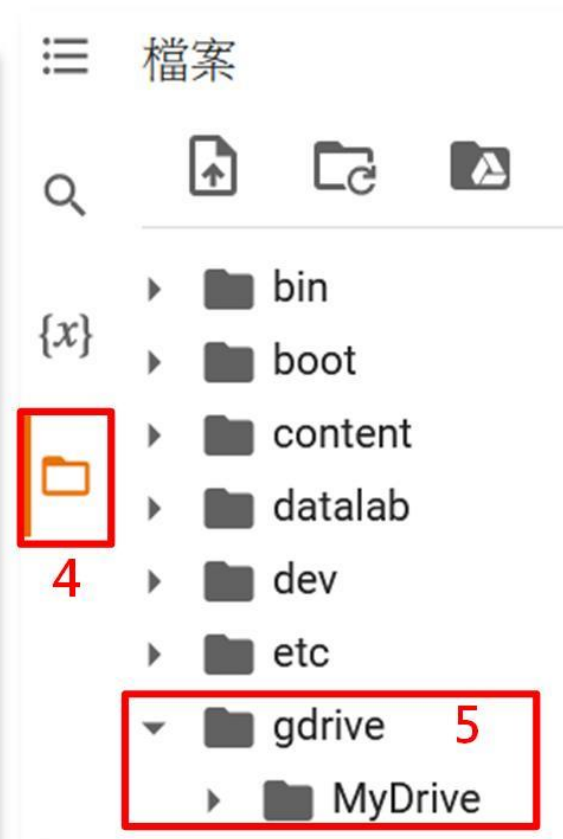
選擇帳戶

以繼續使用「Google Drive for desktop」

omni xri
omnixri@gmail.com **2**

使用其他帳戶

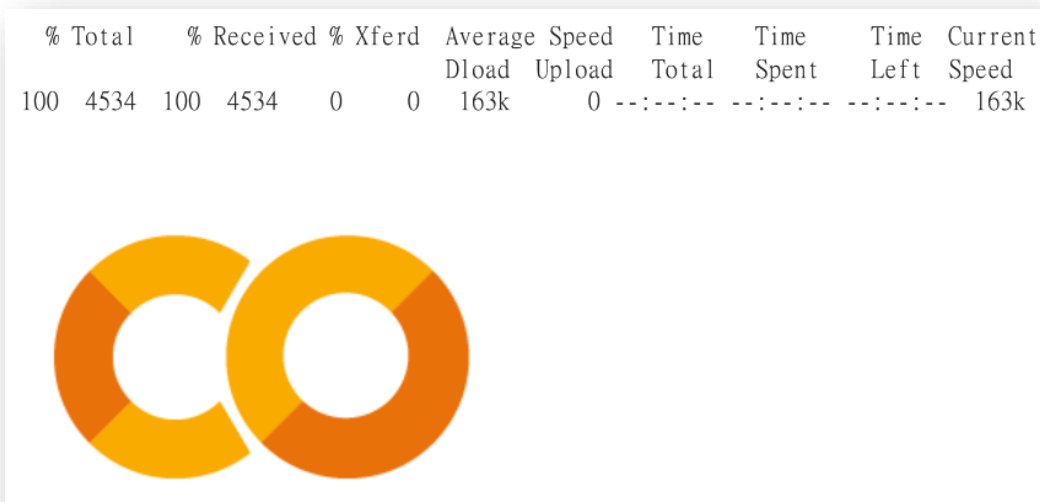
如要繼續進行，Google 會將您的姓名、電子郵件地址、語言偏好設定和個人資料相片提供給「Google Drive for desktop」。使用這個應用程式前，請先詳閱「Google Drive for desktop」的《隱私權政策》及《服務條款》。



更多本機和雲端檔案存取 <https://colab.research.google.com/notebooks/io.ipynb>

以Colab方式顯示OpenCV圖像

```
from google.colab.patches import cv2_imshow # 導入Colab函式庫
!curl -
o logo.png https://colab.research.google.com/img/colab_favicon_256px.png
import cv2 # 導入OpenCV函式庫
img = cv2.imread( 'logo.png' , cv2.IMREAD_UNCHANGED) # 讀入圖檔
cv2_imshow(img) # 顯示OpenCV (BGR) 格式影像
```



以matplotlib方式顯示OpenCV圖像

```
import cv2 # 導入OpenCV函式庫
```

```
import matplotlib.pyplot as plt # 導入matplotlib.pyplot函式庫
```

```
img1 = cv2.imread( 'gdriver/MyDrive/xxx.jpg' ) #讀入掛載之雲端硬碟中的影像檔或者先以!wget指令從網路上下載影像到虛擬機上再讀入
```

```
img2 = cv2.cvtColor(img1, cv2.COLOR_BGR2RGB) # 將影像色彩空間從 BGR888 轉成 RGB888
```

```
plt.axis("off") # 設定關閉XY軸刻尺
```

```
plt.imshow(img2) # 繪製單張影像
```

```
plt.show() # 顯示影像
```


Matplot配合Grid widgets繪圖

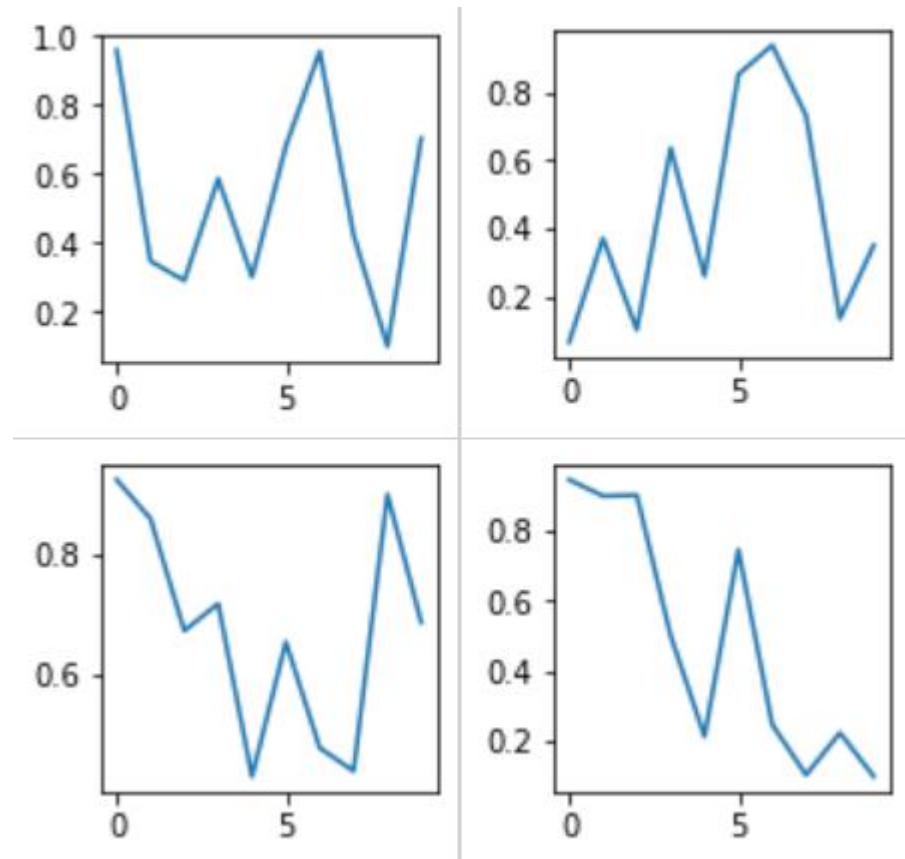
```
import numpy as np
import random
import time
from matplotlib import plt
```

設定Grid為2x2

```
Grid = widgets.Grid(2, 2)
```

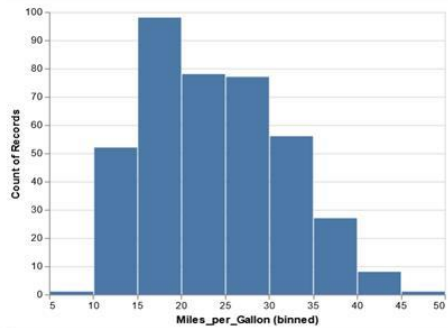
```
For I in range(20):
    with grid.output_to(random.randint(0, 1
), random.randint(0, 1)):
        grid.clear_cell()
        plt.figure(figsize=(2, 2))
        plt.plot(np.random.random((10, 1)))
        time.sleep(0.5)
```

➤ 輸出結果

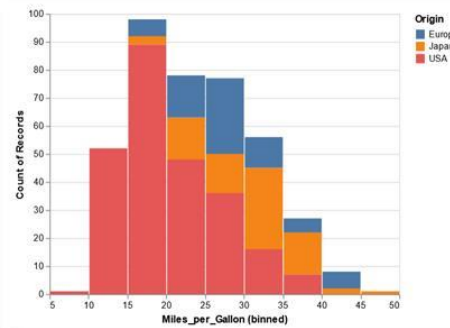


資料可視化 (Altair)

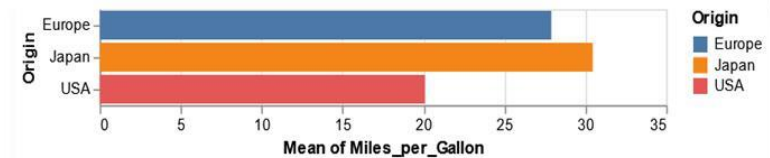
Google Colab - Visualization in Altair



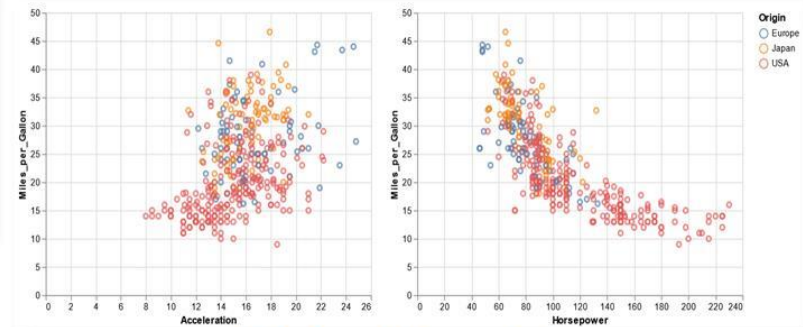
Histogram



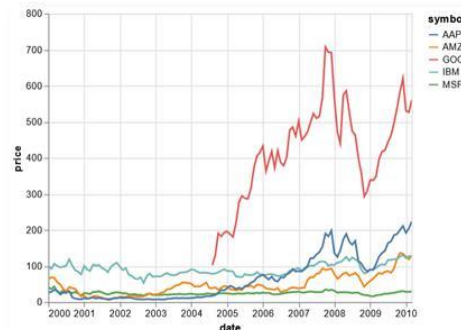
Stacked Histogram



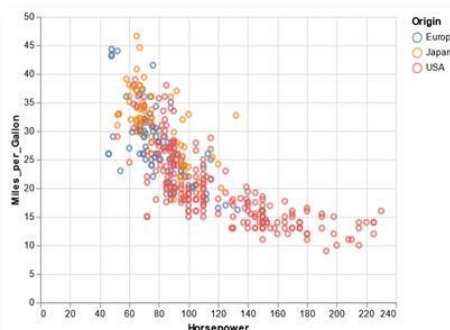
Bar Plot



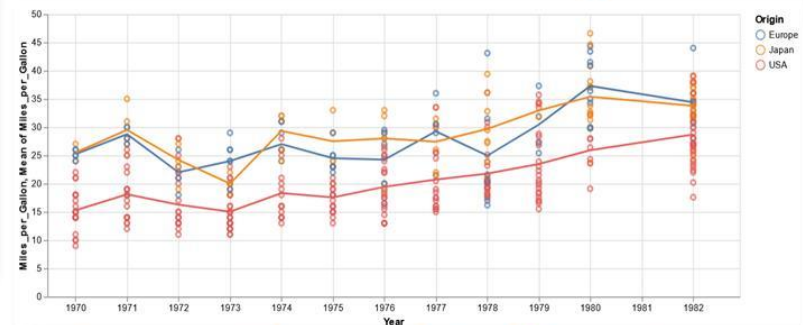
Linked Brushing



Time Series
Line Plot



Interactive
Brushing / Scatter



Scatter Plot with Rolling Mean

小結

- Google Colab提供了很多現成的範例（程式碼片段）方便使用者學習及開發。
- Colab支援 Java 和 Python 之間的溝通，方便透過網頁驅動遠端（雲端）和本地端的連結及互動。
- 提供基本操作元件，方便設計簡單人機互動介面。
- 可輕易整合Python版本的影像處理及繪圖函式庫，包括 OpenCV, PIL, Matplotlib等。
- 提供第三方資料可視化(Visualization)元件，方便顯示數值資料分佈。

參考文獻

- Google Colab官方說明文件

<https://colab.research.google.com/>

- NTUST Edge AI Ch 4.3.1 Google Colab基本介紹

<https://omnixri.blogspot.com/p/ntust-edge-ai-ch4-3.html>

- 許哲豪，如何在Colab上顯示雲端硬碟(Google Drive)上的影像和視頻

<https://omnixri.blogspot.com/2020/12/colabgoogle-drive.html>